Wetland Creation and Restoration

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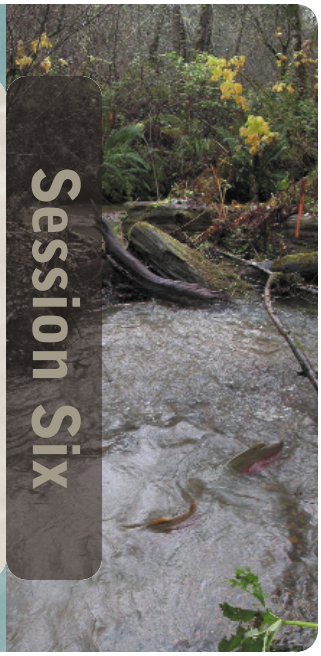

ABSTRACT

This paper discusses the work of Ducks Unlimited and the factors the organization considers in designing projects and estimating their costs.

INTRODUCTION

Ducks Unlimited (DU) started in 1937. We completed our first restoration project in 1938 in the Canadian prairies primarily focusing on ducks. Since that time, DU has expanded its efforts all over the Continental U.S., across Canada, and into Mexico. A substantial amount of work is done in the Pacific Northwest, where DU now has five engineers on staff. Of course, the focus is much more than ducks these days. In fact, over 900 species have been recorded at restoration projects developed by DU and others. Fish are also considered in many of our restoration activities.

It should be noted that about 40% of all threatened and endangered species use wetland systems at one or more points in their life cycle. DU focuses on habitat-based conservation. Some of our objectives as we look for restoration opportunities are to mimic the natural hydrology of the site when that's possible, promote diverse communities of native wetland plant species, and provide a mosaic of habitat types for multiple species of fish and wildlife.

Emergent wetlands are one of the types of systems that we typically work in. They are an important part of the ecosystem and, of course, waterfowl are drawn to them in large numbers, so we've worked with emergent wetland restoration for a number of years. It has been and will continue to be a primary focus for our projects.

DU has also started to do considerable riparian restoration, as it relates to water quality improvements and fish enhancement projects. Many of our typical marsh projects involve a substantial riparian component (up to 25%). We are also working on the coast (bays and estuaries) with a number of projects (at Willapa Bay, for example). These types of projects are quite different from some of our "normal" wetland restoration projects, and it is something that we are beginning to do a lot more of.

SITE ASSESSMENT

In the initial stages of the project implementation process, site assessment should occur. Factors that can affect project success and costs include suitability of soils, topography, hydrology, potential impacts to neighbors, presence of threatened and endangered species, and presence of invasive species (which are becoming much more of a problem in any restoration project).

Soils

Soils must be assessed carefully, because it is important not to spend a lot of money trying to restore an area that may not hold water. This sounds simple enough. However in some cases we're really not restoring wetlands; we're creating them if the soils have not had a history of wetland development and are not hydric. A good analysis of the soil is the first step in any wetland restoration project.

Hydrology is an obvious consideration. For instance, suppose you have an area that looks like a wetland. This area may be functioning properly in terms of its hydrology, but in reality it is partially drained at the far end and the drainage ditches have not been kept up. So in reality, the hydrology has not been restored; if you wanted to restore the hydrology, the project would probably be more of an enhancement.

One of the things you can look at to see the effects of hydrology on a project are a hydrograph. Hydrographs give you a feel for what sort of a system you have. They provide elevation information and, if your site happens to be in a flood plain (e.g., a floodplain wetland), you can calculate where the elevation is in the flood plain and get a picture of how the hydrology varies across the site.

One would never imagine that many areas restored by DU had once been wetlands. This is the sort of thing we run into often, when working on either private land or, in some cases, a public refuge. Often the land has been completely drained by tile systems for agricultural purposes. In many cases what's needed is to break those tile lines and let the hydrology return itself to the area.

Potential Impact on Neighbors

Another key consideration is the impact your project has on your neighbors. A good example is a site just outside of Salem, Oregon. An historic channel of the Willamette River formed a large shrub swamp and emergent wetland, but it has been drained for over 100 years now. The site produces incredible agricultural ground, but we want to restore a part of it to wetland. One of the neighbors, a farmer, doesn't want to do any restoration. The challenge is to figure out what needs to be done to ensure restoration in the area and yet not impact the farmer who wants to continue farming.

This, of course, impacts cost. We might have to build levies to protect the farmer from flood waters and, on the other side of the levy, we might have to build a ditch to collect any water that might seep through the levy — so that we don't impact the neighbor on the other side.

Species Considerations

Consideration is needed for a lot of other species. DU still primarily focuses on waterfowl, but all of our projects have an impact on other species. Consideration of threatened and endangered species is a key part of this. As we develop sites, we have to be very careful about the impact our work may have on other species. An extensive species survey and botanical survey often becomes a vital component of the initial assessment of the site (and costs).

Invasive species are also a very big factor. Comparing restoration at a site where you have invasive species to one where you have a primarily native wetland plant community

shows significantly different effects on costs and planning. An example of an invasive species is Reed Canary grass, a big problem all over the western side of the Cascades. To really restore an area with this type of invasion, you have to scalp a lot of the Reed Canary grass out, and allow some of the native plants to germinate and try to compete with the remaining Reed Canary grass. You will never eliminate it, but you must reduce it.

Locating and referring to reference sites is important. You can go back and reference these areas and have a clear goal of where you are heading with your restoration activity. It also helps in assessing a site because it lets you visualize what that site may become one day. Of course you may do that at different geographic scales to determine how that affects costs.

COST APPROXIMATIONS

Information is needed in three areas to provide a reasonable first approximation of project costs. These areas include topographic surveys, project design, and the actual construction costs. When we do these initial estimates of cost, we often do not have any funding in hand, so topographic surveys and designs are not yet done. That does make it a little more difficult to estimate costs but, if funding is available and designs are completed, construction costs can be refined significantly.

Topographic Surveys

Topographic survey costs will vary considerably. Some sites may be very wet and choked with weeds, making access very difficult. Other sites may be dry and driveable with a truck or an all-terrain vehicle and we can get surveys done quickly. In this case we can survey several hundred acres in a day with a geographic positioning system (GPS) unit. Other sites are very thick and a GPS survey will not work, so traditional survey methods have to be used.

Project Design

An issue to consider is what we call the "partner" factor. The more partners involved in a project, the more difficult it is to reach consensus on what is to be done, thus raising the planning costs. Each partner may want to see something a little different, and this tends to add to planning costs as well as restoration costs. This may not be something we typically think of, but it is a factor to be considered.

Of course, permits are a consideration, depending on the type of project. Some projects need more permits than others and that impacts costs.

The scope of the work is a factor — whether we're building levees to impound water or excavating ponds. Typically excavating dirt is cheaper on a per-yard basis, but it's much more expensive on a per-acre basis to create that impoundment than levees are. Building levees are much more cost-efficient.

Another consideration is the source of water. Does a new gravity flow system need to be constructed, or can an existing water source and gravity flow system be implemented? Or will you need to construct a pump station to get water to the site? This also brings up the question of diesel versus electric as your power source for a project. If you are in a remote location you might choose diesel. Electricity brought to a site often is very costly.

What is the level of design? Are you building levees and installing typical, off-the-shelf water control structures, or are you going to do something more complicated? You may have a water diversion structure that requires a fish ladder or screen incorporated into it, for instance.

Construction Cost Considerations

- *Location of site:* We need to consider where the site is and if we are going to have high mobilization costs to get equipment on-

site. Are any road improvements or clearing needed? Are there reliable local contractors, or will we need to bring them in from a long distance? These issues will tend to drive the costs of a project up.

• *Imported materials:* The soils surrounding the site may not be suitable for the type of structure you want to build, so you may have to import material. Import of materials can be very expensive depending on the availability of material needed, distance to haul it, and the availability of equipment and people necessary to haul and deliver it.

• *Type of equipment:* The equipment necessary to do the job can vary significantly in expense. Scrapers for instance, are very cost effective. However there are some sites where scrapers simply cannot be used.

• *Inspection:* Depending on the complexity of the design and the trust in those doing the work, inspection levels and cost can vary significantly.

• *Size of the project:* Obviously if you are moving 100 yards of dirt, it is much more costly per yard than moving 10,000 yards of dirt, on an economy of scale.

• *Length of the project:* If the project is going to last longer than a year, maybe two or three, you need to take inflation into account. Also, each time the contractor comes back they will charge for mobilization, which will increase costs. The Davis-Bacon Act concerning prevailing wages may impact costs as well.

• *Contingency:* There is always something we run into during construction, or even during the design stage, that was not accounted for. You should typically add a contingency to your cost estimates.

• *Maintenance:* These costs vary depending on the type of restoration. Perhaps the project is a permanent pond that is fed with gravity water, with very low maintenance. Management of vegetation might require disking or mowing. If a pumping plant is involved, there are higher maintenance costs. Also, depending on the size of the restoration, we might purchase the equipment for the maintenance versus renting. It also depends on the landowner. If the landowner is a farmer with none of the equipment needed to do the job, we might have to hire a contractor. On the other hand, if the landowner is a federal agency, they may have plenty of equipment to do the job themselves.

DU maintains a bid summary on all projects, so that when we estimate big projects we can go back and see what the unit prices were on previous projects. We have unit prices for various types of work: mobilization, stripping, earthwork, riprap, structures, etc. So we have a good idea of what the going rate is. We typically don't break up costs by equipment, labor, etc. Those costs are included in the unit prices for specific items of work.

WAYS TO REFINE CONSTRUCTION COST ESTIMATES

As mentioned above, by doing a topographic survey and conceptual design, you can more accurately estimate what the quantities are. This will help refine the scope of work, and allow you to more accurately estimate the construction costs.

If you can get contractors on site, they are a good source of information. Contractors are often more than happy to come out and look at projects if they know that they will get a chance to bid on it. Then, of course, you can get bids on a project. This will let you know where you stand with respect to the funds available.

Data Sources

The RS Means Catalog lists all types of construction activities with costs broken out by equipment, labor, and material. It is a good source of information. Blue Book rates for rental equipment are easily available. There is also a lot of information available on the Internet. Again, contractors are a good source of information.